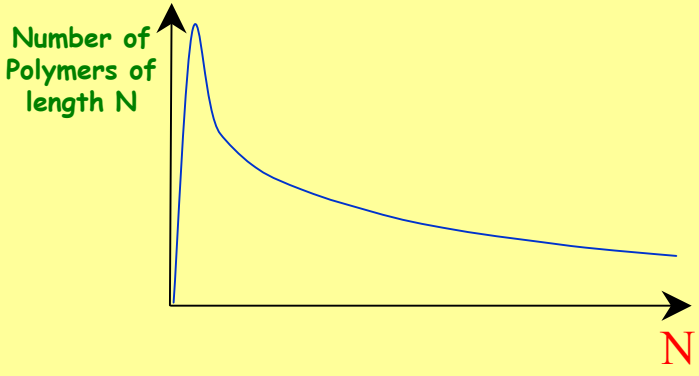
Laser Control of Radical Polymerization

Ben O'Shaughnessy, **Columbia University**, DMR-9816374

- Free Radical Polymerization → Billions of pounds of polymer materials annually
- Our Research : Fundamental Theories of Polymerization
- Can we learn how to control polymer products?

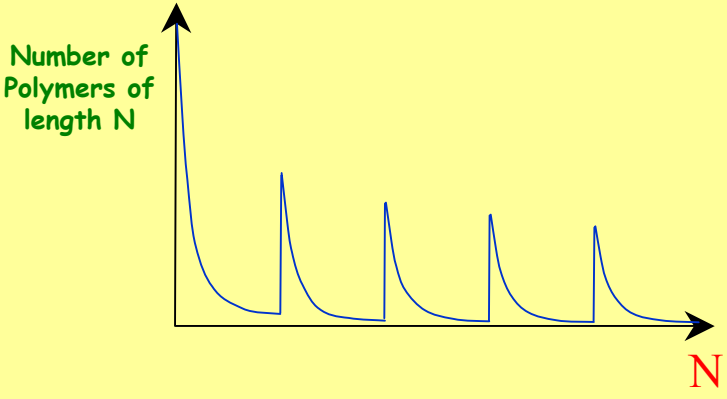
Molecular Weight Distribution (MWD)



Conventional steady state radical polymerization

Broad featureless MWD

Laser pulse control



Our theory predicts **multimodal MWD** *at high conversions*

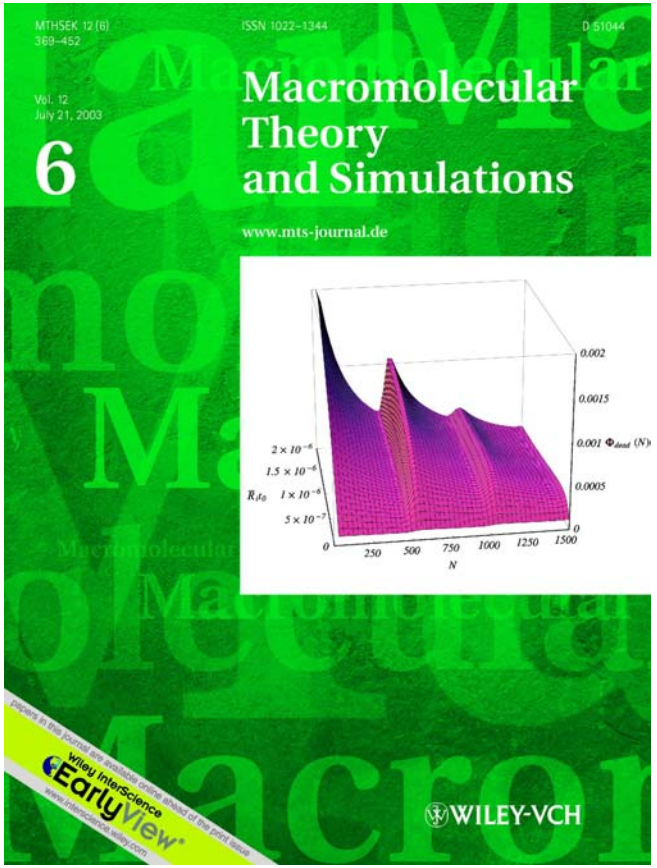
Laser Control of Radical Polymerization

Ben O'Shaughnessy, **Columbia University**, DMR-9816374

- Theories of polymer physics are used to establish basic polymer mechanisms
- High conversion (late stage polymerization) : **entanglements dominate**
- Due to entanglements, polymer production is suppressed between laser pulses : **This is the origin of multimodal product**
- Multimodal product can have greatly enhanced physical properties
- Other work : **Pulsing at low conversions**

Junior researchers involved in this work :

Jaeup U. Kim (graduate)
Dimitrios Vavylonis (postdoc)



Low conversion laser-pulsed polymerization : ***standard method to measure propagation rate coefficients***

Our research : ***effect of radical transfer and broadening on MWD (this work featured on Macromolecular Theory and Simulations coverpage)***